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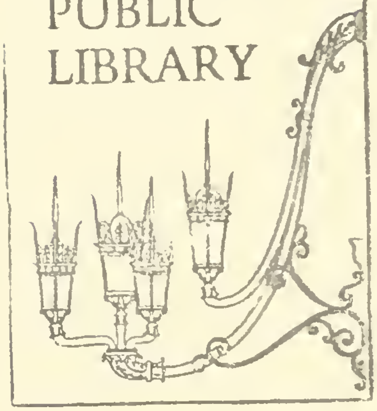

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Long Wharf Phase II

Supplementary Report

Task II - Schematic Design

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PREPARED FOR

THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
THE BOSTON REDEVELOPMENT AUTHORITY

PREPARED BY

SASAKI ASSOCIATES, INC.
64 PLEASANT STREET
WATERTOWN, MASSACHUSETTS 02172

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AUGUST 1986

Long Wharf Phase II

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INTRODUCTION

At the request of Ms. Catherine C. Barner of the Commonwealth of Massachusetts, Executive Office of Environmental Affairs, Department of Environmental Management and Mr. Philip Zeigler, Boston Redevelopment Authority, Sasaki Associates, Inc. has prepared this supplementary report for the schematic design phase of the Long Wharf Reconstruction.

Issues addressed in this report are those items outlined in a letter from Ms. Barner and Mr. Zeigler to Sasaki Associates dated August 8, 1986.

403.04

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Management

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pment

August 8, 1986

Mr. Edward Fitzerald
Sasaki Associates
64 Pleasant Street
Watertown, MA 02172

Dear Ed,

In order to complete Task 2 of the Long Wharf Contract, the Department and the Authority have requested that Sasaki Associates provide additional narrative or sketches for the following work.

1. Expand the "Design Narrative" to include a more detailed evaluation of the design program, analyze the engineering problems and opportunities and explain why certain materials and designs were proposed for Long Wharf
2. Site Circulation Plan - pedestrian and traffic circulation
3. Analyze the impact of existing conditions on the schematic design
4. Compile DEM/BRA Schematic design comments and prepare a general response

We look forward to reviewing this work.

Sincerely,

Catherine C. Barner
Project Manager

Philip Zeigler
Project Manager

CB PZ/jl

LONG WHARF BULKHEADS

The construction of Long Wharf took place from the early 18th century to the mid-19th century. By later 19th century, the original 2200 ft. length of the wharf had been shortened to less than 1000 ft. which moved the shoreline from the Custom House to its present location near the middle of the Marriott Hotel. What appears to be the wharf surface is, in fact, the deteriorated floor structures of the United Fruit Company steel clad sheds, all that remains after demolition of those buildings. Fringing the granite bulkhead of the original wharf is a highly deteriorated wood pile - supported timber deck that obscures the original granite stone work. This decayed timber grillage and deck is of a later period than the original wharf structure.

The construction methods utilized to build Long Wharf were developed by engineers of the Roman Legion two millenia ago and later adopted by British Engineers who transferred the techniques to the new colonies including India and the Americas. There were three basic techniques of stone bulkhead construction on soft and yielding waterfront soils. They are as follows:

- The first was to construct a cofferdam consisting of two rows of woven reed mats supported on poles between which mud was placed. The cofferdam formed a ring around the construction area. The area was dewatered, unsuitable soil was removed by hand, and a gravity stone bulkhead was placed in the dry. This method was limited to shallow water and mud depths.

- The second method was the use of timber piles driven by dropping a weight from a block and tackle supported by an "A" frame or gin pole configuration. The weight was pulled up and released by a crew of men working in unison. Piles were driven to adequate bearing as determined by experience, and the tops were set below the mud line to avoid rot and exposure to marine organisms. Cofferdams, as per the first alternative, were used if the tops of the piles had to be below low water and couldn't otherwise be sealed by mud dike enclosures. The pile cap consisted of a very large stone, maneuvered into place using gin pole and block and tackle. This capstone spanned many piles and provided a stable base for the remainder of the bulkhead wall construction, which was carried to a pre-determined height above high water.

- The third method was to float in place a previously constructed open timber crib with a grillage timber floor. This crib was held in position by guide piles and sunk to the harbor bottom by filling it with stones from a barge brought alongside. A massively large base stone was placed across the top of the sunken crib and additional stonework was laid. The added weight caused consolidation of the subsoil, and the stonework was gradually brought up to final grade. This allowed displacement and consolidation effects to generate enough soil strength increase to support the desired superstructure

height of the bulkhead wall. This entire method could be carried out without dewatering and was appropriate no matter how deep the sediments might be.

The common thread of all the construction techniques used was that they were empirically established, based on trial and error. As bulkhead walls were carried into progressively deeper water or softer sediments, the wall section would eventually prove to be too narrow, and the wall would tip. When this happened, the stones would be laboriously removed for reuse, the section would be widened and construction would proceed. Because, in this early period, labor was of very low cost relative to the materials used and other economic factors, this labor-intensive trial and error method was quite practical.

However, the safety factors for the structures produced were barely above one. The most likely time for the structure to collapse was in its early years, when the subsoil was going through its maximum consolidation and strength gain. If it didn't collapse in the first few years, it was likely to last through the centuries, provided that the timber supports were below the mud and not exposed to oxygen or marine borers, and that the structure was not altered in some unforeseen way. For this reason, contemporary, conservative geotechnical analyses often yield theoretical safety factors for these structures at or less than one, and are not relevant.

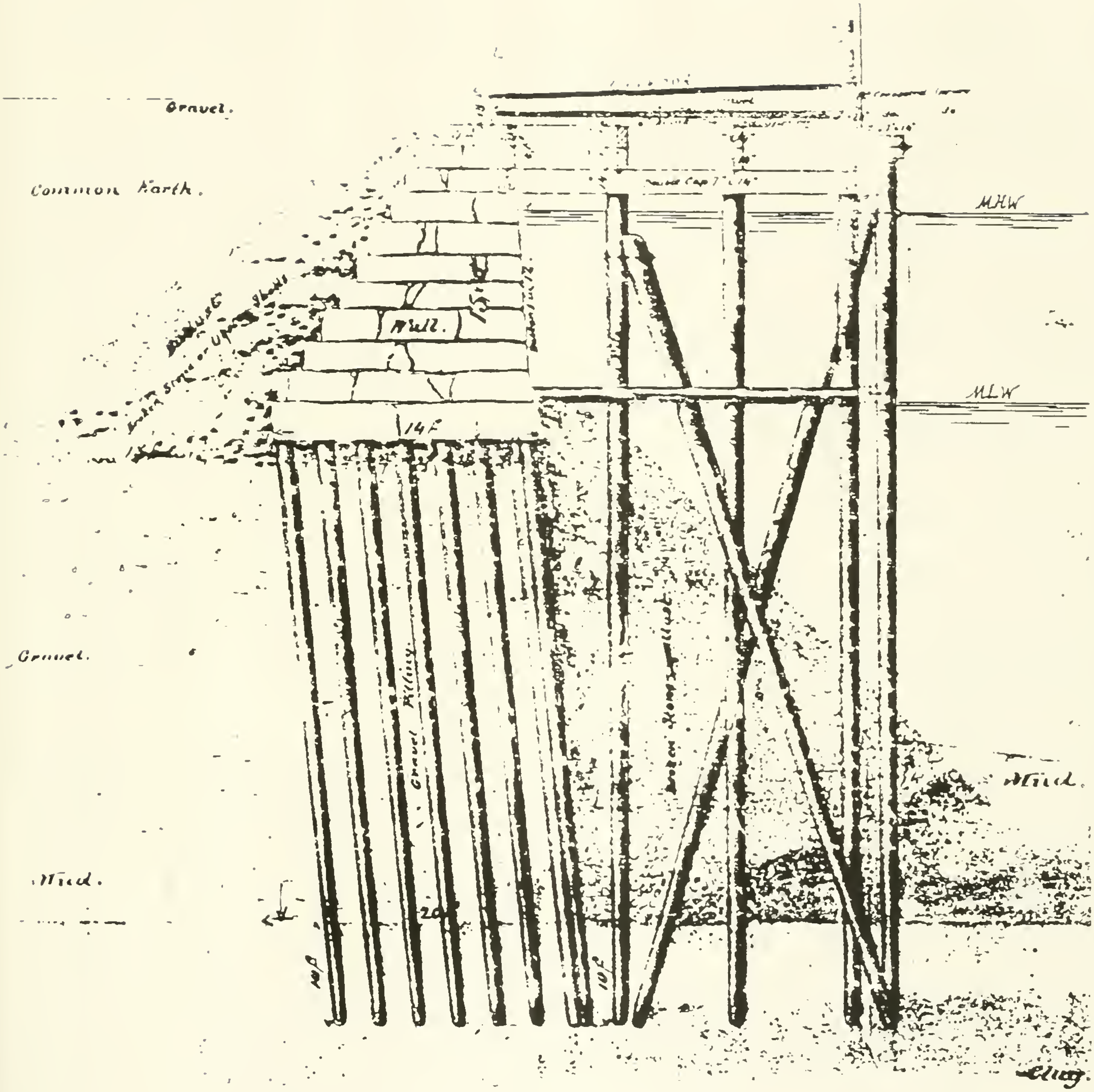
Evaluation of Long Wharf

Crib-supported walls are used in Salem along the South River Channel, in portions of Boston Harbor (see Figure #1). From what records Sasaki could find, at least a portion of the Long Whawrf granite bulkhead is pile supported, with piles approximately 30 to 40 feet long penetrating a 6 to 15-foot top layer of organic silt and peat and fetching up in the Boston Blue Clay that is prevalent in the harbor area (see Figure #2). The original granite wharf was constructed in 1712 and extended 2200 feet into Town Cove. Subsequent widenings and enlargements of the granite bulkheads took place at least in the years 1763 and 1824, and last in 1847 when the wharf was brought to its present configuration. Additional timber decking was added at the perimeter of the wharf to expand its surface area.

Restoration

Planning for Restoration

A key design consideration for restoration is the necessity to raise most of the bulkhead, as little as possible, but, at least to elevation 13.5 BCB (to allow for overtopping only a few times each year). It has been judged that a lower elevation would overtop too frequently and create a public and maintenance nuisance, and a higher elevation would add undue



Section Showing Proposed Bulkhead at Long Wharf, 1869

Figure 2

cost and loading with little subsequent benefit. In addition, measures were proposed to raise the interior of the wharf to 15.5 BCB, an elevation consistent with the first floor of the Cutom House Block, the major wharf building. The older Chart House building is slightly lower at 14.5 BCB. The wharf buildings are subject to infrequent flooding when winter northeasters drive Boston Harbor waters to 16.5 BCB. [illegible] Flood tide elev.

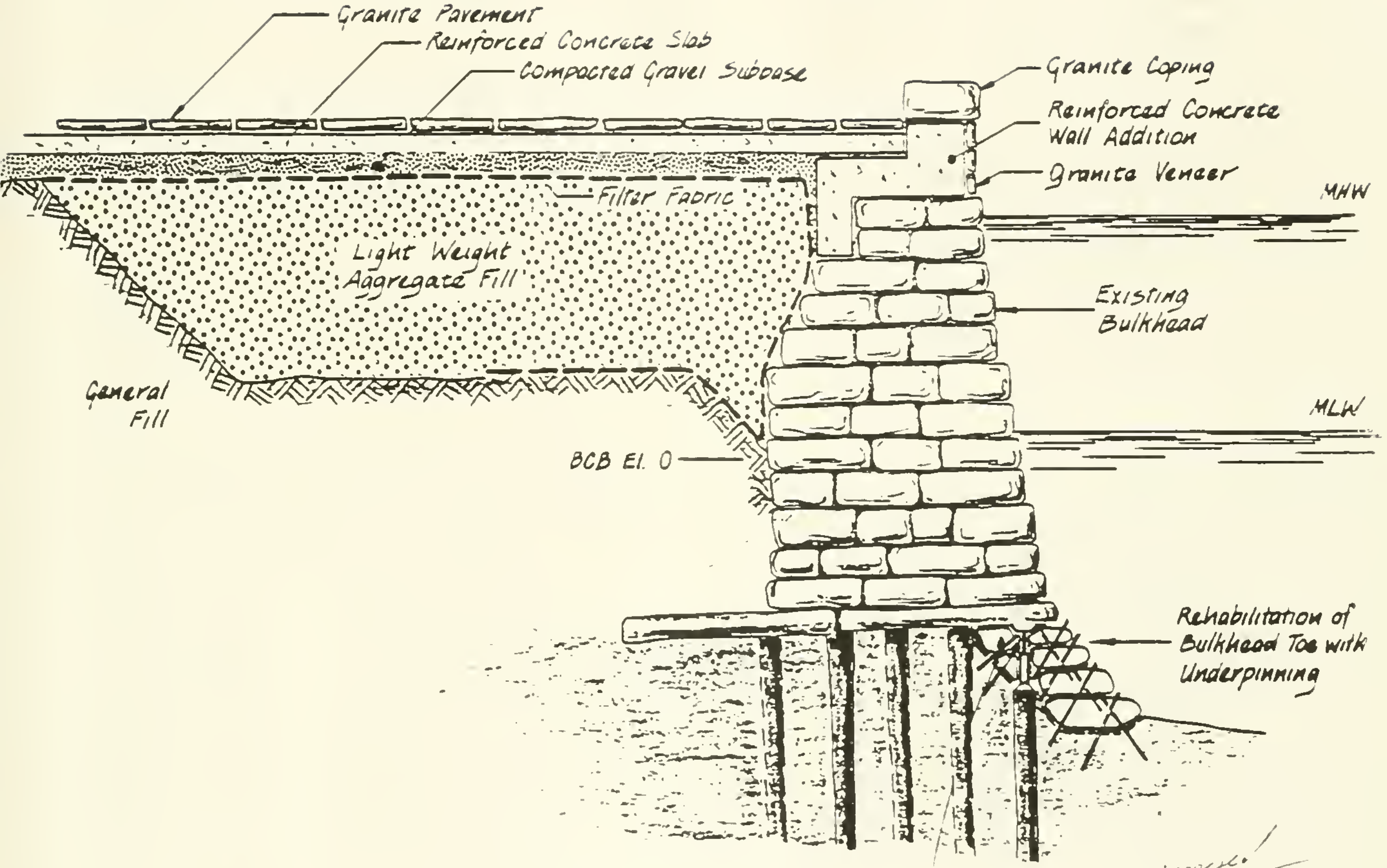
Recognizing the slim safety factors that might be expected from such walls (per the historical analysis), a method of using lightweight fill behind the wall and modern filter fabric against the old stones (see Figure #6) has been recommended to prevent soil migration through wall interstices (the roughness of the stones was noted earlier). This is combined with adding concerete fill and new granite stones where needed to bring the entire bulkhead periphery to 13.5 BCB. - wall

The added weight of stone on the face of the wall increases compression and stability, while the removal of conventional fill at 125 to 130 pounds per cubic feet (pcf) and its replacement with lightweight aggregate at a density of 75 to 80 pcf behind the walls would allow for raising the wall without increasing overturning or displacement forces.

In those instances where scour has removed muds protecting timber support pilings, piles will have deteriorated and replacement will be necessary. During Phase I, after considering a number of possibilities, Parsons-Brinckerhoff, Quade & Douglas and Sasaki jointly concluded that the most economical and practical repair method would be to have divers cut away deteriorated timber, replace pilings with screw jacks to establish full bearing and fill the void with concrete filled fabric bags stabilized with epoxy coated steel rods (see Figure #3). This same procedure would be used for the balance of the wall. ?

Further inspections of the southwest section of Long Wharf's bulkhead was made at low tide by Maurice Freedman, P.E., Chief Engineer at Sasaki Associates accompanied by Thomas DiCicco, P.E., Long Wharf project engineer, and Heather Thompson-Ryan, Project Manager. The segment so inspected was from Atlantic Avenue to the east end of the niche, which is the beginning of the repair/reconstruction of the Phase I contract. [illegible]

The exterior face of the bulkhead is partially obscurbed by the old timber pile and grillage structure and because of the density of this remaining timber structure it was not possible to get directly to the wall and therefore observations were made from floating docks that serve the vessels moored on the south face some 20'± from the wall. It was not possible to observe the top or back of the wall since this area is covered by the concrete slab, which is the old first floor of the United Fruit Co. warehouse shed which previously occupied this area. The upper portions of this warehouse has been demolished.



Bulkhead Rehabilitation

Figure 3

In contrast to the Phase I bulkhead walls, which show high quality granite blockwork, and the presence of long longtitudinal strangers or tie pieces, which exercise a three dimensional stability for the restored wall, the southwest bulkhead wall has significant portions that appear to be of a considerably lower quality of construction. Small, irregular blocks and poor placing are characteristics of a significant segment of this wall. In addition, some localized failures had been observed, some of which could be attributed to the construction of the foundations for the United Fruit Co. sheds.

However, this observed portion of the wall is subject to considerably less wave energy than the outboard portions of the wharf and water depths in this location are know to be significantly shallower than depths at the outboard portion of the wharf. The combined effects of lower wave energy and water depths indicated that this portion of the bulkhead is subject to consideraoly less stress than those of the Phase I area; therefore, a lesser quality wall in this location may prove serviceable and repairable.

Because of concerns about the quality, and the lack of proper access for inspection, accompanied by our recent experience in Phase I, in which an 80' segment of a poorly constructed wall collapsed, Sasaki recommended that an inspection program be undertaken during the design stage to remove a portion of the concrete slab covering the wall, and excavate by backhoe a slit trench behind the wall so that there could be a detailed examination of several suspicious portions of the bulkhead wall thereby determining, more accurately, the extent of repair necessary. In order to produce our initial planning estimates of "probable cost" for the Long Wharf Phase II construction, for budget purposes it was conservatively assumed that approximately thirty-five percent (35%) of this face would have to be completely reconstructed. It is believed, based on past experience and in consideration of the lesser forces extent in this portion of the wharf and with general project contingency allowance, that this will adequately address the situation for budgetary planning purposes.

Of course, it is vital to move ahead, as quickly as possible with the further exploratory work which Sasaki recommended, so that a better engineering understanding of this bulkhead wall segment can be had.

A complete reconnaissance of the wharf perimeter at low tide was made to carefully observe four relevant visual factors:

- Horizontal longtitudinal alignment - to monitor settlemen;

- Vertical longtitudinal alignment - to monitor bulging or displacement;

- Face batter - to monitor rotation or overturning, and

- Wall condition - to monitor loose, missing or displaced stones.

Horizontal and vertical alignment and residual face batter all indicated that the portions of the bulkhead which could be observed were standing up well to the centuries, and only a few localized stone failures or displacements were noted in the face of the wall. However, the top of the wall was quite irregular, and numerous top stones had been removed or displaced. Part of the reason for this is that the stones themselves were very roughly cut by hand and have irregularities that cause a tipsiness in the top stones. In addition, a number of very well constructed and interesting stair niches provided access to small boats at low tide. (The predicted tide in Boston Harbor ranges from 8.6 to 13.8 feet). Subsequent field surveys revealed that the top of the wall ranged in elevation from 8.5 to 12.5 Boston City Base (BCB - approximate mean low water). Even the higher elevation is approximately one foot lower than the present extreme high tide. Since it is reported that the ocean level has risen (or the land level subsided) by about one foot or so in the past century, it is possible, and likely, that the original top of the wall had been brought to the ten extreme high tide level.

PIER AND FLOATS

The pier of of timber construction. The structure is supported by timber piles on a 10' x 5' grid spacing. Design loadings are 100 lbs/sq. ft. live loads. At present, three inches (3") structural timber decking is proposed.

[illegible]

Based upon existing subsurface information provided by the BRA, pile lengths have been estimated to be 70 feet. Design borings will be taken to determine actual design length of piles. The structure will include lateral truss design to withstand lateral loading. A fender system will be installed.

[illegible]

A concrete float system will be used if whale systems can be modified to offset heavy loads imposed by docking of large commuter passenger vessels. Other possible systems are aluminum and laminated plywood with epoxy coating.

[illegible]

Anchor pile for floats are assumed to be concrete filled steel piles with 12" to 16" diameters. Marine hardwood (basralocus) may be a substitute for concretre filled piles depending upon an economic analyses that is to be done.

Dolphin pile system for tieing up large boats?

Do existing piles not removed!?

MATERIALS

As noted in the Schematic Design Narrative, materials selected for Long Wharf are used to "enhance visual clarity and walking convenience". Brick has been used extensively in the area in Waterfront Park, Quincy Market, the Marriott Long Wharf, Phase I and the New England Telephone Building site. The proposal for Long Wharf is to continue the use of brick in those areas where there will be pedestrian activity; that is, the upper area of the wharf and, to use granite on the lower "working wharf" area.

In a historical context, old photos of the wharf show brick used along buildings with granite on carriageways. Wood was used early on for an edge sidewalk which was later replaced with a "hard" edge (concrete).

During the Schematic Design Phase, Sasaki undertook a pavement study of Long Wharf. The study developed a matrix to rank granite, brick and wood as to how each might be appropriate for various locations on the wharf. Five general items were evaluated: historical significance, maintenance/durability, relationship to existing architecture and/or pavement, cost, and urban context. Each was ranked on a scale of 1 to 5 with 5 representing the highest or best ranking.

A copy of the matrix evaluating zones A thru J follows:

L O S S A R Y

storical Significance – how a proposed pavement material in an area relates to the historical use of that material. For example, in Boston, granite and wood were primarily used in the "working wharf", whereas brick was mainly used for pedestrian purposes.

ntenence / Durability – how the proposed material responds to weathering, waterfront conditions, pedestrian-use, time, etc. — also storm-related flooding ?

lationship to Existing Architecture and/or Pavement – how the proposed material complements the existing surfaces of adjacent buildings, structures and pavements.

st – how the proposed material relates to the following factors: availability, construction/installation cost of the material itself.

ban Context – how the proposed material relates to other existing materials in the immediate vicinity including Faneuil Hall, Marketplace Center, Waterfront Park, State Street and the Aquarium.

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	1	1	1
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	5	2	1
COST	5	3	3
MAINTENANCE DURABILITY.	4	5	2
	20	14	8

PAVING MATRIX

LONG WHARF [illegible]

3·23·86

	BRICK	GRANITE	WOOD.	
HISTORICAL SIGNIFICANCE	1	3	5	
URBAN CONTEXT.	5	3	2	
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	3	2	1	
COST	3	2	5	
MAINTENANCE DURABILITY.	4	5	3	
	16	15	16.	

PAVING [illegible]

LONG WHARF [illegible]

3·23·86

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	5	4	1
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	5	3	1
COST	5	3	3
MAINTENANCE DURABILITY.	4	5	2
	24	18	8

PAVING MATRIX

LONG WHARF [illegible]

3 23 86

	BRICK	GRANITE	WOOD.	
HISTORICAL SIGNIFICANCE	5	3	2	
URBAN CONTEXT.	5	3	1	
RELATIONSHIP TO EXISTING ARCH. & /OR PAVING	5	2	1	
COST	5	3	3	
MAINTENANCE DURABILITY.	4	5	2	
	24	16	9	

PAVING [illegible]

LONG WHARF [illegible]

3·23 86

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	4	5	2
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	4	4	1
COST	5	3	2
MAINTENANCE DURABILITY.	4	5	1
	22	20	7

PAVING MATRIX

LONG WHARF [illegible]

3.23.86

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	1	5	5
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	4	3	1
COST	3	2	4
MAINTENANCE DURABILITY.	2	5	3
	15	18	14

PAVING MATRIX

LONG WHARF [illegible]

3.23.86.

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	1	5	5
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	3	1	1
COST	3	2	5
MAINTENANCE DURABILITY.	2	5	3
	14	16	1[illegible]

PAVING MATERIAL

LONG WHARF [illegible]

3.23.86

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	2	5	5
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	3	4	2
COST	3	2	5
MAINTENANCE DURABILITY.	3	5	4
	16	19	17

PAVING MATRL.

LONG WHARF [illegible]

3·23·86.

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	4	5	1
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	5	4	1
COST	5	3	2
MAINTENANCE DURABILITY.	4	5	1
	23	20	6

PAVING MATRIX

LONG WHARF [illegible]

3·23·86

	BRICK	GRANITE	WOOD.
HISTORICAL SIGNIFICANCE	5	3	1
URBAN CONTEXT.	5	3	1
RELATIONSHIP TO EXISTING ARCH. &/OR PAVING	5	3	1
COST	5	3	2
MAINTENANCE DURABILITY.	4	5	1
	24	17	6

PAVING MATRL.

LONG WHARF [illegible]

3.23.86.

CIRCULATION

The completion of the Long Wharf renovation and park development will bring an increased clarity to the existing circulation systems.

Pedestrian System

The majority of the Long Wharf area is to be dedicated to pedestrians. With increased programs and activities, there will be a continued increase in pedestrian activity.

Vehicular System

There is a need to maintain vehicular access to all areas within the Long Wharf project for service, emergency, delivery, and tenant and owner activities. However, this access is proposed to be controlled and designed to 'read' as pedestrian zones where the vehicle is the foreign object. Existing vehicular activity on State Street, Old Atlantic Avenue, and Central Street will be maintained and reinforced with new curbs, crossings, bus pull-off lanes, and signage.

The overall intent is to leave the automobile at the city edge and make as much of the Wharf a public pedestrian space as possible.

Parking

No long-term parking is proposed within the Long Wharf project area. Short-term parking for service, delivery, and tenant vehicles is anticipated. Short-term parking will need to be enforced by the Authority or its agent.

See the attached Long Wharf plan for further graphic clarification.

IMPACT OF EXISTING CONDITIONS ON SCHEMATIC DESIGN

Whitman & Howard, Inc. (W/H) has been under contract to perform an existing conditions survey of the Long Wharf area. Final manuscripts have been submitted to Sasaki and are under review. Since only minor editing is to be made to the manuscripts, i.e. inverts, gates, etc., the Whitman & Howard plans have been used to assess the accuracy of the Schoenfeld survey which had been used to prepare the schematic design.

The two base plans were compared to determine if there were significant differences between them. In this case "significant" can be interpreted as meaning a disparity that would impact the schematic design such that the program as proposed could not be achieved or major issues such as costs would be affected.

The following represents the major findings:

- The location and footprint of the Long Wharf Hotel, Chart House and Custom House Building are nearly identical with variance between plans being 2± feet and that being restricted to the hotel. The New England Tel & Tel Building and its easterly sidewalk in the W/H survey is located between 2' and 8' west of the Schoenfeld survey thereby providing more space than shown in the schematic design.

- The limits of the gravel parking area are approximately the same.

- The north edge behind the Long Wharf Hotel has no change.

- The granite seawall along the north side from the Custom House to the easterly end of the wharf is approximately the same. The major difference is the existing wall (W/H survey) has several jogs which are not shown on the Schoenfeld survey. Alignment varies from 0' to 6' at jogs. For the most part, there is little difference between the plans.

- The MBTA tunnel (W/H survey) between the Chart House and the MBTA Aquarium Station varies from 3' to 7' to the south of the alignment shown on the Schoenfeld plan.

- The granite wall at the west end of the commuter boat basin is located approximately on the same alignment in both plans. On the W/H plan, the wall is skewed such that at the south end, the wall is 3±' west of the Schoenfeld alignment and at the north end, it is 4±' east.

- The major difference in the two plans is the location of the south granite wall on the wharf. At the west end of the wall, the actual location of the wall as per the W/H plan is 12±' to the south of the Schoenfeld Plan. The difference between the two surveys is proportionately less in an easterly direction until the difference becomes 2±' at a point opposite the westerly end of the Custom House. From that point easterly to the niche in the wall (165±') the W/H survey has the wall 2' to 12' south of the Schoenfeld survey.

This difference means that between the west end of the basin and the Custom House there will be approximately 2,000 s.f. of additional space located in an area where queuing can be expected from boat riders.

Conclusion

The differences between the W/H and Schoenfeld survey have little or no impact on the schematic design. There is a major plus with the south wall actual location being south of the original survey.

Has water [illegible] been checked for alignment — this could impact [illegible].

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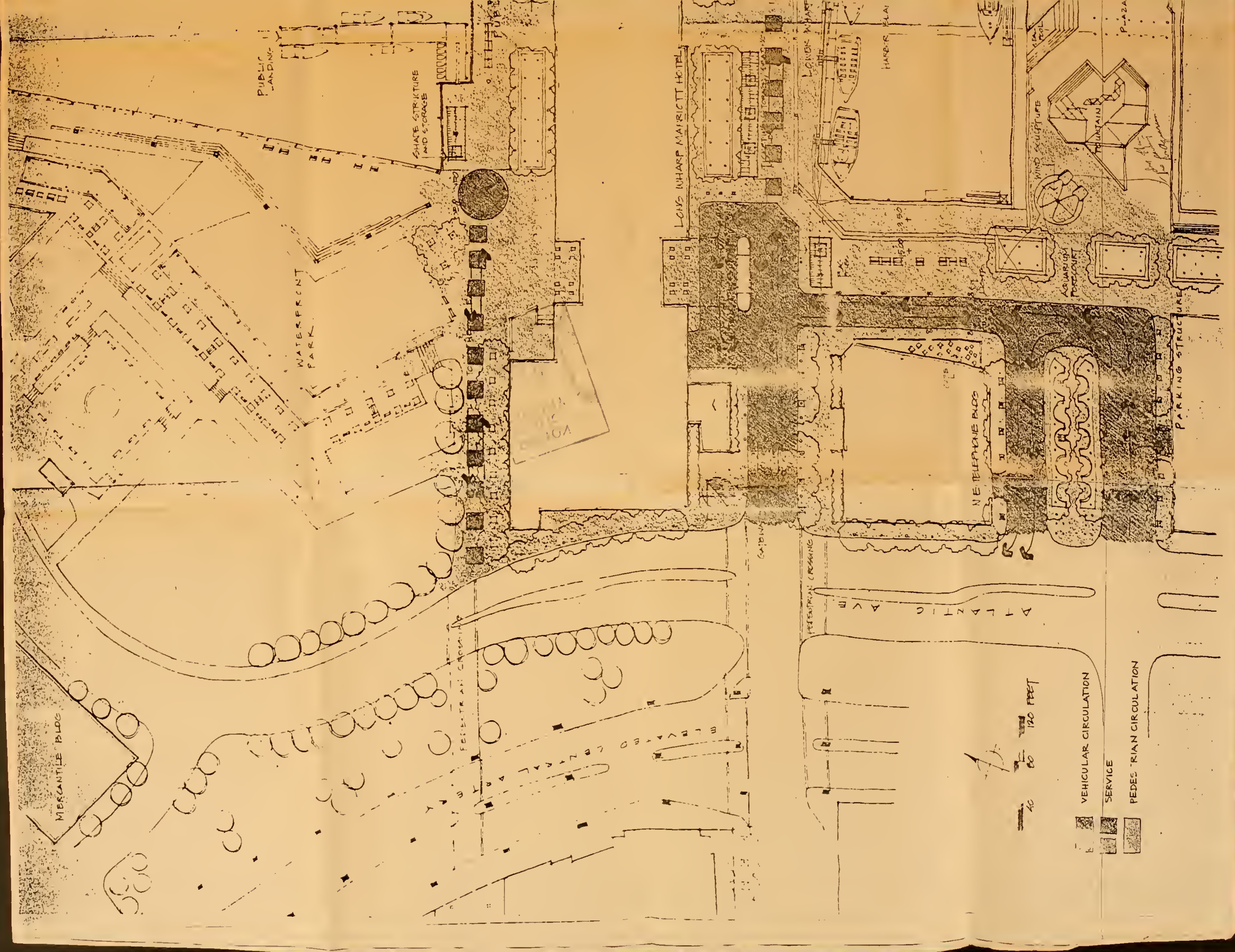
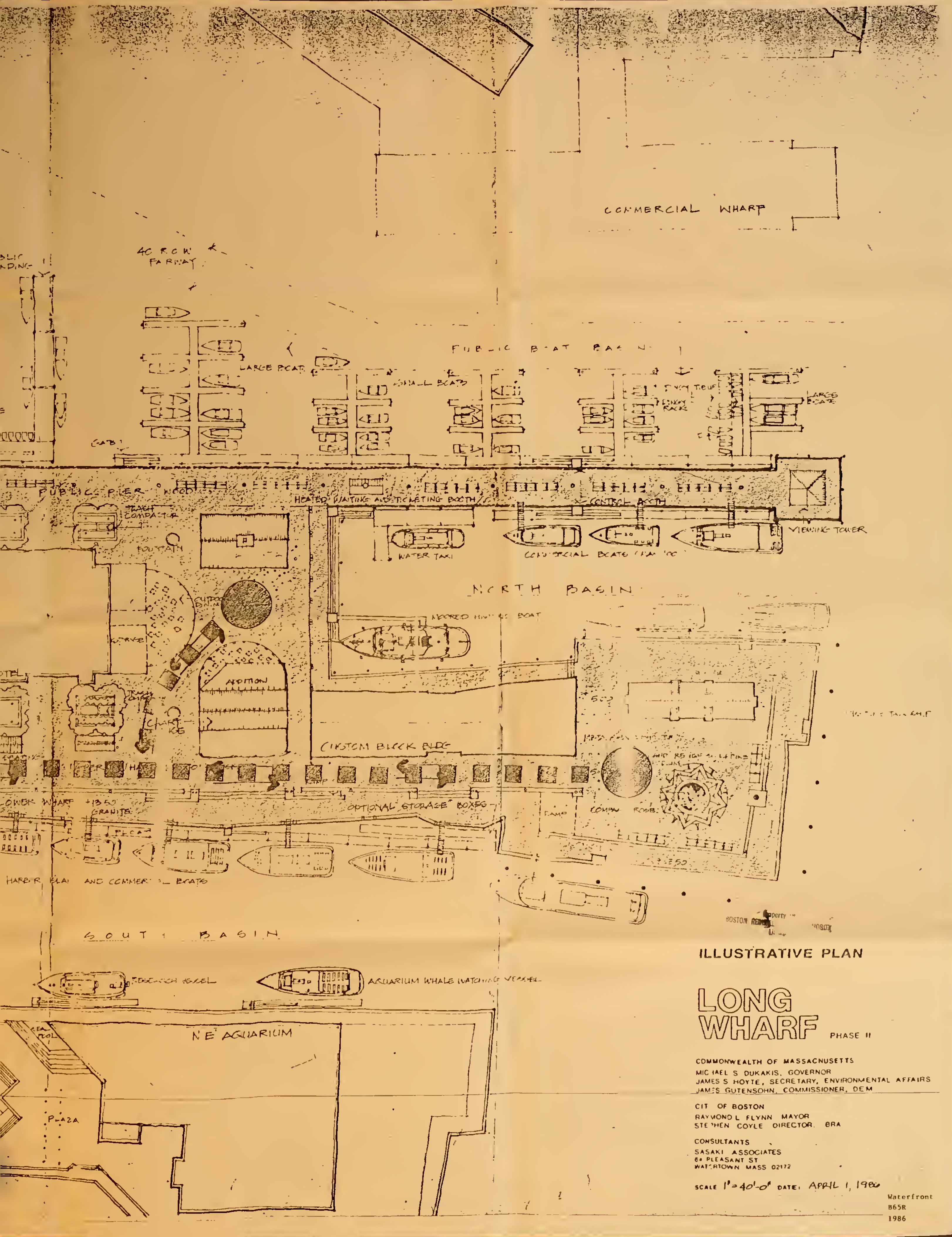

PUBLIC LANDING
SHADE STRUCTURE AND STORAGE
WATERFRONT PARK
LONG WHARF MARRIOTT HOTEL
LOWER WHARF
HARBOR PLA
WIND SCULPTURE
FOUNTAIN
PLAZA
AQUARIUM FORECOURT
PARKING STRUCTURE
N E TELEPHONE BLDG
PEDESTRIAN CROSSING
ATLANTIC AVE
ELEVATED CENTRAL ARTERY
MERCANTILE BLDG
40
80
120 FEET
VEHICULAR CIRCULATION
SERVICE
PEDESTRIAN CIRCULATION



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ILLUSTRATIVE PLAN

LONG WHARF PHASE II

COMMONWEALTH OF MASSACHUSETTS
MICHAEL S DUKAKIS, GOVERNOR
JAMES S HOYTE, SECRETARY, ENVIRONMENTAL AFFAIRS
JAMES GUTENSOHN, COMMISSIONER, DEM

CITY OF BOSTON
RAYMOND L FLYNN MAYOR
STEPHEN COYLE DIRECTOR. BRA

CONSULTANTS
SASAKI ASSOCIATES
64 PLEASANT ST
WATERTOWN MASS 02172

SCALE 1"=40'-0" DATE: APRIL 1, 1986

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